IV. MATERIALS AND PERSONNEL FOR TRAFFIC CONTROL

A. Channelizing Devices

1. General Application

The primary function of channelizing devices is to warn and alert drivers and pedestrians of worksites in, or near the traveled way, and to guide and direct them safely past. By day, the effectiveness of the device is determined by position and visibility. Channelizing devices are used:

a) To protect the work site.

b) To provide for pedestrian movements around the work site.

c) To channel and divert traffic in advance of the work site.

d) To define the travelway through the work site.

e) To define a change in the position of the existing lanes around the work site.

f) To define curves and the edges of the roadway on detours.

g) To separate opposing lanes of traffic.

Channelizing devices shall conform to the following requirements:

a) They shall be of material that will withstand impact without appreciable damage to the device, the striking vehicle or passing traffic.

b) All channelizing devices used at night shall be reflectorized unless otherwise specified herein.

c) The predominant color for the devices, shall be orange.

2. Vehicular Barricades

a. General Requirements

Barricades are channelizing devices used primarily for enclosing a work area, for road closures and detours, for pedestrian control, for marking obstructions and where warranted, for guiding traffic around the work area. All barricades shall be constructed of durable materials in conformance with the dimensions and standards indicated on Table IV-1 and Figure IV-1:

Markings for all barricade rails shall consist of weatherproof reflectorized sheeting with alternate orange and white stripes.

Both orange and white stripes shall be reflectorized. The presence of warning lights mounted on the barricade shall not lessen this requirement, nor shall paint containing glass beads be used to provide the reflective surfaces. The 6" wide reflectorized stripes shall slope downward at an angle of 45 degrees in the direction traffic is to pass. Where barricades extend entirely across a roadway, it is desirable that the stripes slope downward in the direction toward which traffic should move. Where both right and left turns are provided, the chevron striping shall slope downward in both directions from the center of the barricade. Barricades shall be posted in such a manner so as to clearly indicate the extent of the obstruction of excavation.

Barricades shall never be placed in a moving lane of traffic without advance warning including a high level warning device and appropriate delineation and signing.

If it is necessary to ballast barricades to maintain them in an upright position due to high winds or passing vehicles, sand bags or other non rigid material should be used.

When barricades are used during the hours of darkness an operable flashing or steady burning light shall be attached to each barricade.

When used for the purpose of road blockage, barricades should be no further apart than five feet to prevent vehicle from driving between them. If it is necessary to provide space for special traffic, (i.e., local residents, construction vehicles, buses, etc.) signs reading EXCEPT TRUCKS, EXCEPT BUSES, CLOSED TO THRU TRAFFIC AND "LOCAL ACCESS ONLY", or whatever message is appropriate shall be displayed to approaching traffic.

Generally, barricades shall be one of four types: Type I, Type II, Type III or vertical. Characteristics and dimensions for these four types are shown on Table IV-1 and are illustrated on Figure IV-1. Generally, the different type barricades should be used as follows: however, each situation should be evaluated for most desirable application. The Contractors name or identifying number shall appear on the barricade but not on the uppermost reflective panel.

b. Type I and II Barricades (Figure IV-1)

Type I and II are generally considered as portable barricades. Their primary use is to outline work areas, excavations, spoil piles, and similar obstacles. A Type I or Type II barricade may be used to protect pedestrians from the vehicular movements. Type II barricades may be used for street closures only in emergency situations or for very short durations of time.

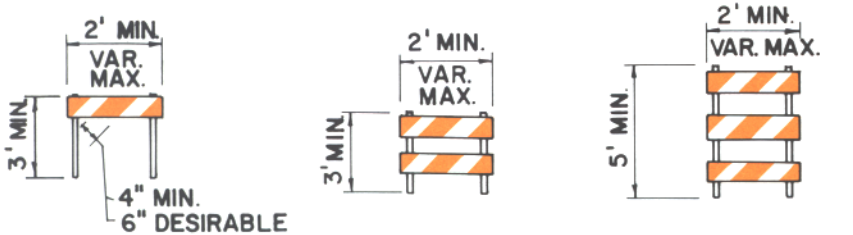
c. Type III Barricade (Figure IV-1)

Because of their high visibility and more permanent nature Type III barricades shall be used whenever it is necessary to close any street for an extended period of time, to protect work areas of prolonged construction projects, or to close a lane or divert traffic from one lane to another on high-speed, high volume facilities where the Type II barricade could be easily overturned by passing traffic.

TABLE IV-1

TYPE	I	II	III
Width of Rail*	8" min. - 12" max.	8" min. - 12" max.	8" min. - 12" max
Length of Rail	2' min. - var. max.	2' min. - var. max	4' min. - var. max.
Number of Rail faces reflectorized	2 (one each direction)	4 (two each direction)	3 if facing traffic in one direction. 6 if facing traffic in two directions.
Width of Stripes **	6 inches	6 inches	6 inches
Height	3 ft. min.	3 ft. min.	5 ft. min.

* For wooden barricades, nominal lumber dimensions will be satisfactory.
** For rail less than 3' long, 4" wide stripes may be used.



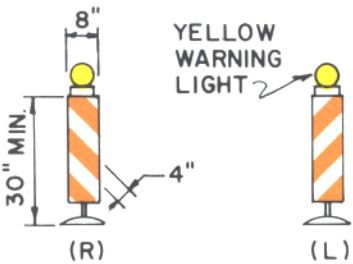
TYPE I * (T-51)

TYPE II * (T-52)

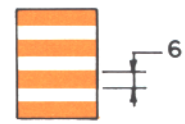
TYPE III * (T-53)

* WITH WARNING LIGHTS, IF REQUIRED

VEHICULAR BARRICADES

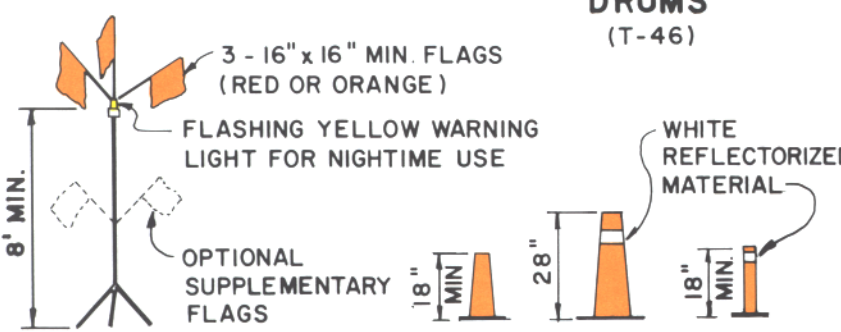


VERTICAL PANEL (T-50A)



DRUMS ARE TO BE PREDOMINATELY ORANGE, BUT A MINIMUM OF 2 WHITE STRIPES PER DRUM ARE REQUIRED

DRUMS (T-46)



HIGH LEVEL WARNING DEVICE

CONE

CONE

GUIDE POST

CHANNELIZING AND WARNING DEVICES

FIGURE IV-1

3. Vertical Barricades (Figure IV-1)

A vertical panel is a channelizing device which aids the driver in determining the location and alignment of the traffic lane. Vertical panels may be used to divide the opposing streams of traffic at night and to divert a traffic lane, or outline the edge of a hazard along the roadway. When a vertical panel is used to divide opposing flows of traffic, both sides of the barricade shall be striped with proper angle slashes.

4. Cones (Figure IV-1)

Cones may be used to channel and divert traffic in advance of work sites and to define the travel way through the work site. Traffic cones may be used during daylight hours, but alone are not sufficient for nighttime use.

Minimum height for traffic cones shall be 18". Where traffic speeds are high or where increased target value is needed, 28" high cones shall be used. Because they are easily knocked over by wind or by passing vehicles, cones should be checked frequently to insure that they are in the intended position.

For night time use, cones shall be at least 28" and reflectorized. Reflectorization shall be provided by a min. 6" white band placed max. of 3" from the top.

5. Tubular Guideposts (Figure IV-1)

Tubular guideposts cover a wide range of devices all of which can be effectively used to channelize and divert traffic in the same application as cones. Generally, these devices consist of a round or rectangular plastic tube fastened to a base plate of similar material as shown on Figrue IV-1. Reflectorization shall be provided by a min. of two, 3" white bands. Placed max. of 2" from the top with max. of 6" between the bands.

6. Drums (Figure IV-1)

Drums may be 55 gallon metal, but preferrably specially fabricated plastic of similar dimension, set on end and used as an expedient method of traffic channelization. Because of their universal nature, drums can usually be used in the same application as other channelization devices including Type I and Type II barricades, i.e., to define work areas, divert traffic, protect workers and support signs. The predominant color on drums shall be orange with at least two horizontal, circumferential white stripes 4 to 8 inches wide. Drums shall be reflectorized and shall never be placed in the roadway without advance warning signs and/or proper delineation. In addition, a flashing warning light should be added when drums are used singly, at night and steady burning warning lights or arrow warning signs when they are used for ballast when it is necessary to prevent overturning such as when signs are attached.

7. Others

Various other approved channelizing devices may be used such as temporary flex beam guardrails and median barriers.

B. Channelizing Device Placement

For maximum effectiveness, the following rules shall be observed in placing channelizing devices for the purpose of channeling and/or diverting traffic:

1. Place channelizing devices in continuous rows. For each row the devices should be of the same type.

2. The channelizing devices should be placed and anchored if necessary to prevent being knocked out of position by passing traffic. Where used to define traffic lanes, sufficient lane width should be provided so that trucks and buses will not strike them. Additional lane width and clearance may be required on curves and at intersections, where the "tracking effect" of wide swinging semi-trucks tend to knock over and crush improperly placed devices.

3. The channelizing devices shall be placed with their broadsides, lamps, and reflectors facing traffic.

4. Where used to close a traffic lane and to transition oncoming traffic, the minimum taper length and spacing between the devices shall be as indicated in Table X-1. The minimum desirable length indicated in Table X-1 applies to roadway conditions of relatively flat grades and straight alignment. Adjustments may become necessary to provide adequate sight distance on the approach to the channelization. Similarly, the proximity of interchange ramps, crossroads, etc., to the work site may dictate the need for adjustments. In general, improved traffic flow will result when the adjustments consist of increasing the length of the taper rather than reducing the length below the minimum desirable as stated in Table X-1.

C. High Level Warning Device

The primary use of a high level warning device is to provide advance warning of a work area by being visible to a driver even when the work area is obstructed from view by vehicles or construction equipment.

High level warning devices shall consist of either three flags, a Type "B" warning light or a vehicle mounted flashing yellow warning light for daytime use. For nighttime use a Type "A" light may be substituted for a Type "B' and flags alone shall not be used.

High level warning devices with flags or warning lights shall be a minimum of 8 feet high; and shall be designed to resist overturning by the wind while minimizing vehicular damage should it be inadvertently struck. Flags should be 16 inches square or larger and iridescent red or orange in color.

The high level warning device shall be required for all temporary work in the roadway and may be used to supplement warning signs. Depending on the situation, high level flags may be attached to a service vehicle or placed directly on the roadway in advance of the obstruction. The device should be placed in the middle of the closed lane and shall always be placed behind appropriate channelizing devices as indicated in the illustrations. Normally, one unit should be used for each lane closed; however, additional units may be used if appropriate. A high level warning device should always be the first traffic control equipment to be placed as it will provide a degree of protection during the positioning of other devices.

D. Illumination and Lighting Devices

Often, persons working in the right-of-way only see the job site during the daytime; it is also necessary to protect the public and the job site during the hours of darkness.

During the day the obstruction may be clearly visible, and channelizing devices may be merely of secondary importance. However, at night the ditch or spoil bank may not be visible, and the public is reliant upon properly illuminated warning devices. Also, it is important to realize that barricades, signs and other traffic control devices are themselves useless and potential hazards unless they can be seen after dark.

All traffic control devices, except parking and pedestrian control signs, used during the hours of darkness shall be properly reflectorized as described elsewhere herein. In addition to these requirements, other devices may be applied during the hours of darkness.

1. Torches and Lanterns

   Torches include all the single unit, portable, constant-burning low-intensity type lights, of either the battery powered or open flame variety. Lanterns include all enclosed flame type units. Because they are undependable and provide little illumination, these devices shall not be used.

2. Flashing Yellow Warning Light (Vehicle mounted)

   Flashing yellow warning lights for mounting on vehicles shall cast a yellow light radially through 360 degrees. Such lights should be approximately 5 inches high and 5 inches in diameter and shall be rated at 750 candle power as a minimum. Strobe type flashers may be a lesser dimension.

   When mounted on equipment they shall be positioned such that maximum visibility from all sides is achieved. Lights shall be such that a minimum sustained flash rate of 60 flashes per minute is produced. Light pulsations may be achieved by either rotation of the light source or a strobe-type unit.

3. Steady Burning Electric Lamps

As used herein, steady burning electric lamps shall mean a series of low wattage yellow electric lamps. Where lights are needed to delineate the traveled way through and around obstructions or to separate opposing traffic in a construction or maintenance area, the delineation should be accomplished by use of steady burning lamps.

4. Floodlights

Electric lights can be used for floodlighting hazardous conditions, signs, channelizing devices, and flagger stations. Lights used for illuminating signs or channelizing devices shall be sufficient in size and number to provide effective illumination and legibility under normal atmospheric conditions. Precautions shall be taken when placing lights to insure the prevention of glare.

5. Warning Lights

As used in this Manual, barricade warning lights are portable, lens directed, enclosed lights. The color of the light emitted shall be yellow and may operate either in the flash or steady burn mode. These devices shall meet the current ITE purchase specification for flashing and steady burning warning lights.

WARNING LIGHTS

	Type A Low Intensity	Type B High Intensity	Type C Steady Burning
Lens Directional Faces	1 or 2	1	1 or 2
Nighttime Visibility	3000'		3000'
Daytime Visibility		1000'	
Minimum Height	36"	36" - 96"	36"
Hours of Operation	Dusk to Dawn	24 hours/day	Dusk to Dawn

Type A Low Intensity Flashing Warning Lights are most commonly mounted on the advance warning signs, Type II barricades, vehicle panels, or on independent supports, and are generally used to warn motorists or pedestrians of an extremely hazardous situation.

Type B High Intensity Flashing Warning Lights are normally mounted on the advance warning signs or high level warning devices. Extremely hazardous site conditions within the construction area may require that the lights be mounted on Type I and II

barricades, signs, or other supports. As these lights are effective in daylight as well as dark, they are designed to operate 24 hours per day.

Type C Steady Burn Lights are intended to be used to delineate the edge of the traveled way on lane changes, on lane closures and on other similar conditions. When mounted on vertical panels they may be used to separate opposing flows of traffic.

6. Advance Warning Arrow Panel

Advance warning arrow panels are sign panels with a matrix of lights capable of either flashing or sequential displays. Advance Warning Arrow panels are intended to supplement other traffic control devices. Arrow panels will not solve difficult traffic problems by themselves, but they can be very effective when properly used to reinforce signs, barricades, cones, and other traffic control devices. Necessary signs, barricades, or other traffic control devices shall be used in conjunction with the advance warning arrow panel.

Arrow panels are effective in encouraging drivers to leave the closed lane sooner. Arrow panels provide additional advance warning and directional information where traffic must be shifted laterally along the roadway. They assist in diverting and controlling traffic around construction or maintenance activities being conducted on or adjacent to the traveled way and give drivers positive guidance about a roadway path diversion that they might not otherwise expect.

Arrow panels are generally used for day or night lane closures, roadway diversions, and slow-moving maintenance and construction activities on the traveled way. They are particularly effective under high-speed and high-density traffic conditions. At night, they are effective where other traffic control devices cannot provide adequate advance warning of a roadway path diversion. During daylight, arrow panels are effective under high-density traffic conditions that might block the driver's advanced view of construction or maintenance activities ahead.

E. Pavement Markings

The City Traffic Engineer shall review with the Contractor situations that merit either the removal of existing pavement markings or the application of temporary markings. Where existing pavement markings conflict with the temporary markings, consideration shall be given to their removal depending upon the extent of conflict and the relative hazard produced. The City Traffic Engineer shall make the final determination. All pavememt markings shall be removed and/or applied by the Contractor as approved or directed by the City Traffic Engineer. Upon completion of construction, all pavement markings and channelization removed/or damaged shall be replaced by the Contractor.

F. Flaggers

1. Qualifications

Since flaggers are responsible for human safety and make the greatest number of public contacts of all construction personnel, it is important that qualified personnel be selected. All flaggers must possess a card certifying that they have completed the flagger's course as approved by the State of Washington Department of Labor and Industries.

2. Equipment

All personnel acting as flaggers shall wear a predominantly red or flourescent orange jacket or vest and a yellow, white or orange safety helmet at all times. Jackets or vests shall be properly worn and buttoned or zipped for maximum effectiveness.

The flagger shall also be equipped with a standard STOP-SLOW hand paddle or pole-type paddle. Sign paddles should be at least 18 inches wide with 6 inch letters. A rigid handle should be provided. This combination sign may be fabricated from sheet metal or other light semi-rigid material. The background of the STOP face shall be red with white letters and border. The background of the SLOW shall be orange with black letters and border.

For nighttime operations, jackets and vests shall be reflectorized. Also, the STOP face of the paddle shall be reflectorized red with white reflectorized letters and border, and the SLOW face shall be reflectorized orange with black letters and border. In addition to the reflectorized clothing and STOP-SLOW paddle, the nighttime flagger should also be equipped with a flashlight, or other lighted signal device. The flashlight or signal device shall be equipped such that a red color is visible and shall be used to accentuate hand signals which may otherwise not be visible. Care must be taken however, that the light is not of such intensity as to produce glare to oncoming traffic or obscure the sign message.

3. General

Sometimes traffic control equipment alone is inadequate, and therefore, flaggers should be used:

a. Where workers or equipment are intermittently blocking a traffic lane.

b. Where equipment is backing.

c. Where only one-lane is available for two directions of travel. When the one-lane section is visible from one end to the other end, traffic shall be controlled by means of flagger at each end of the section. One of the two should be designated as the chief flagger for purposes of coordinating movement.

They should be able to communicate with each other verbally or by means of signals. These signals should not be such as to be mistaken for flagging signals. When the end of a one-lane section is not visible from the other end, the flagger may maintain contact by means of radio or field phones or additional flaggers may be stationed at intermediate points. If the one-lane section is short, one flagger only may be used to handle both directions of traffic.

d. Where traffic control equipment is being placed or removed in the roadway.

e. In emergency situations until proper traffic control equipment can be obtained and properly installed.

f. When existing traffic signals are to be countermanded, only a law enforcement officer shall be the flagger.

Other general rules pertaining to flaggers include:

a. At no time shall a flagging station be left without a flagger.

b. Stopped motorists should be advised as briefly as possible of the reason for the delay and its approximate duration.

c. The flagger should avoid conversations or arguments with motorists.

4. Stations

Flagger stations shall conform to the following criteria whenever possible (see illustration in Chapter VII):

a. They should be stationed far enough in advance of the work area to properly slow or stop traffic before it enters the work area.

b. Normally, the flagger should stand on the shoulder of the roadway, but should at all times remain clearly visible to the approaching traffic. They shall never stand in the traffic lane directly in the path of an approaching vehicle.

c. At a "spot" obstruction where a single flagger controls traffic from both directions, the flagger should normally be positioned on the shoulder opposite the work area.

d. Flaggers should stand apart from the other crew members and shall not mingle with others while on duty. Flaggers should be aware of their position relative to construction equipment such that they do not blend in with their background.

e. Flagger stations shall be adequately protected by signs as indicated in the illustrations in Chapter X especially in the case where one-lane is being utilized for two directions of travel. In other instances, as where the flaggers are needed only to provide for the safe crossing of the traveled roadway by construction vehicles, advance signing is not generally needed.

f. During the hours of darkness, flaggers' stations should be lighted if possible.

5. Control Procedures and Signals

Flagger signals to traffic should be as indicated below:

a. SLOW - Daytime Traffic

Hold the STOP-SLOW paddle in the right hand with the SLOW message facing approaching traffic. The paddle should never be waved to attract attention as this renders the message difficult to read. Once traffic slows to the desired speed, the left hand should then be used to motion traffic to proceed. When signaling traffic to proceed, hand motions should be made slowly such that drivers do not interpret the movement as a signal to increase their speed.

b. SLOW- Nighttime Traffic

Nighttime operations are similar to daytime operations as pertains to hand signals. The STOP-SLOW paddle shall always be reflectorized as indicated previously. The flashlight or other lighted signal device should be held in the left hand such that drivers can see hand motions more clearly.

c. STOP - Daytime Traffic

Hold the STOP-SLOW paddle raised and extended away from the body in the right hand, making certain that the paddle is not in a position such that the red background blends in with the red garment being worn. Hold the left arm upraised and extended with the open palm toward traffic. For attention, the left hand may be waved from side to side until the first cars have come to a complete stop, however, the paddle shall not be waved. Once the first vehicles have come to a complete stop, the flagger may move into a conspicuous position near the centerline such that he can be clearly seen by traffic in the rear. The flagger shall remain in this position with the STOP message continually displayed toward the traffic until they are permitted to proceed.

At no time shall a flagger display the STOP message as a means of slowing traffic only, as this encourages motorists

to disregard such signals in the future and creates a potential hazard.

d. STOP - Nighttime Traffic

Procedures for stopping traffic at night are similar to those used for daytime operations. As indicated previously, the STOP-SLOW paddle shall always be reflectorized. In addition, the flagger should have a flashlight or other lighted signal device which is held in the left hand.

e. Release Stopped Vehicles

To release stopped vehicles, the flagger should move to the shoulder of the roadway well out of the traffic flow. After turning the paddle to display the SLOW message he should then motion slowly with the left hand for the traffic to proceed. Again rapid motions of the arm should be avoided, as this might be interpreted by motorists as indicated impatience or a motion to hurry.